WILLINGNESS TO PAY OF AIR TRAVEL PASSENGERS FOR CARBON OFFSET PROGRAM IN AVIATION INDUSTRY

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Abstract - Recently, a greenhouse gas (GHG) emissions become the raisingissue in the transportation sector. Air transport sector contributes approximately 2% of global greenhouse gas emissions. Reducing greenhouse gas emissions from aircraft is one of the issues taken seriously by the transportation sector. However, air transportation has implemented several ways to reduce carbon emissions, and one of them is by launching carbon offset program. This study estimates the willingness among Malaysian airline passengers to pay for carbon offset program to have a better environmental performance. Using a single and double-bounded dichotomous choice of contingent valuation method (CVM), we estimate how much air passengers would be willing to pay to offset carbon emissions generated by their travel. The results obtained from this study suggest that in average,the Malaysian air passengers are willing to pay RM82.35 for the carbon offset program in aviation industry.

Keywords - Contingent valuation method, Willingness to pay, Carbon offsets, Greenhouse gas emissions, Airline industries

I. INTRODUCTION

In the new global economy, air transportation is one of the growing transport demand. Cheaper and more abundant flights can make travel easier, for both local and abroad trip (Chapman, 2007). However, this sector has an impact on the environment, as it increased the greenhouse gas (GHG) emissions (Somerville, 2003; Chapman, 2007). Aviation is thus a significant and increasingly important contributor to global warming, as carbon emissions from air travel released in the upper troposphere and lower stratosphere, where they havethe larger impact on ozone generation (Gössling et al., 2007). Among all transportation, air transportation accounted for about 2% of total emissions. It is not significantly high but still considerable. Chang, Shon and Lin (2010) mention that, the incentive and any policies made to reduce GHG emissions of surface transportation are most likely not suitable for air transportation sector.

Thus, there are several ways that Malaysian airlines have implemented to reduce greenhouse gases problem such as the limit number of luggage for each passenger, use an environmental engine,and another initiative is by implementing carbon offsets program. Becken and Hay (2012) explained that carbon offsetting is a form to neutraliseemissions released by investing in schemes that reduce greenhouse gases through some projects offered such as reforestation or renewable energy. The carbon offset program is now popular throughout the world, but still applied as a volunteer program(Chang, Shon and Lin, 2010). Unless Malaysia, airlines around the world use a variety of ways to get involved with offsetting, include in their air ticket prices, and some provide an option for customers to purchase offset at the market (Mair, 2011).Back in 2008, MAS has launched the voluntary carbon offsets program for their flight, called “towards a greener future”. However, this program does not show any progress. Lack of awareness and information about that program was believed to be the reasons why it cannot be sustained. MacKerron et al. (2009) stated that, respondents willing to pay for carbon offset only if they have information in term of education and awareness about the offset program schemes. Thus, this study aims to estimate the appropriate price level for carbon offsets program in the airline industry, concerning to improve and re-introduce the carbon offset program in Malaysian aviation industry.

This paper is divided into four sections; where section one is the introduction of the study, followed by section two which explained the methodology and source of data used. Empirical results are presented in section three, which comprises results and discussion, and the last section is the conclusion of the study.

II. METHODOLOGY

Contingent valuation method (CVM) is widely used in areas of economics such as in health economics, cultural economics, transportation, as well as in environmental economics. Recently, this method has been commonly used in environmental economics. There are four types of eliciting technique used in contingent valuation methods, namely the bidding game, payment card, open-ended and dichotomous choice. As noted by Arrow et al. (1993), the dichotomous question is the most recommended eliciting technique in contingent valuation study. This method is the most suitable survey instrument to elicit a monetary value in a non-market good (Bateman et al., 2002).

This study applied the single and double-bounded dichotomous choice approaches. In this approach, respondents were presented with a first bid, whether they are willing to pay or not. If “yes”, the higher level of the bid will be presented. If “no”, the lower

level of the bid will be presented, followed by the open-ended question, which respondent need to fill the maximum value they are willing to pay. The double-bounded logit model is more efficient compared to single-bounded in terms of the information obtained about respondent's willingness to pay (Bateman et al., 2002).

This study used the primary data, and it was collected through interviews in the form of questionnaires. A total of 500 Malaysian airlines passengers were interviewed. Information on demographic characteristics of respondents obtained included gender, race, marital status, age, education level, occupation, as well as monthly income (Table 1).

Table 1. Demographic profile of respondents

Respondents' profile	Frequency	Percent (%)
Gender:		
Male	153	30.60
Female	347	69.40
Race		
Malay	725	87.67
Indian	21	2.54
Chinese	66	7.98
Other	15	1.81
Marital Status		
Single	497	60.10
Married	321	38.81
Other	9	1.09
Age		
Less than 20	7	1.40
20 – 29	174	34.80
30 – 39	207	41.40
40 – 49	73	14.60
50 – 59	36	7.20
60 and above	3	0.60
Education level:		
No formal education	3	0.60
Primary school	100	20.00
Secondary school	17	3.40
Professional certificate/diploma	57	11.40
Bachelor degree	244	48.80
Master / PhD	79	15.80
Occupation		
Government	121	24.20
Private sector	171	34.20
Own business	66	13.20
Retiree	6	1.20
Unemployed	8	1.60
Student	61	12.20
Housewife	13	2.60
Self-employed	54	10.80
Income		
Below RM1000.00	43	8.60
RM1001 – RM2000	75	15.00
RM2001 – RM3000	86	17.20
RM3001 – RM4000	115	23.00
RM4001 – RM5000	78	15.60
Above RM5000.00	103	20.60

Before the actual survey was conducted, a pre-test was carried out to test the questionnaire. This is to ensure the respondents' understanding of the questions. Respondents were interviewed for the pre-test. Pre-test questionnaire does not have any bid price, onlyhas the open-ended question. From the open-ended question, it was then transformed into bid price, which ranging from minimum to maximum price obtained from an open-ended pre-test question.

The personal interviews have been conducted among passengersof Malaysia Airline (MAS) and Air Asia flight, by filling the questionnaires at Kuala Lumpur International Airport (KLIA) and Kuala Lumpur International Airport 2 (KLIA2) departure and arrival hall.Each of the respondents was briefed on the details of the purpose of preservation of area, facilities available and format used in contingent valuation technique. Respondents were asked the following question and required to respond either 'YES' or 'NO'.RM X ranged from RM5 until RM100 will be a reasonable price for voluntary carbon offsets.

Flying like many others forms of transport impacts the environment because the fuel used by airlines results in the release of carbon dioxide (CO2) and other emissions into the upper atmosphere. As flying becomes cheaper and accessible, the problem is heading towards the sky. Carbon offsetsare one of the ways for airline passengers to „neutralize" their amount of an aircraft"s emissions by investing in carbon offsets project. If you were to buy a voluntary carbon offsets, the carbon emissions from your consumption will be compensated elsewhere, by investing in some projectssuch as renewable energy or by investing in energy efficiency. An additional charge RM X for carbon offset will be imposed on your plane ticket to reduce and minimise emission by investing this carbon offset fund on mentioned offset projects.

III. RESULTS AND DISCUSSION

An initial estimation of the model using all the demographic characteristics as independent variables reveals that all variables come out with different results in the single and double-bounded model. The maximum likelihood estimates of the specification for single and double-bounded logit model are estimated using STATA, version 11. The results of logit model for single and double-bounded areshown in Table 2. The value of Pseudo R^2 is 0.0901.The results demonstrate a little different between single and double bounded logit model. Single-bounded logit model shows variable age significant at 10%, gender at 5% and income significant at 1% respectively. However, in the double-bounded logit model, all variables are significant at 1% except age. It can be seen that the double-bounded logit model performed better than the single-bounded logit model in terms of the log-likelihood function. Hence, the mean willingness to pay (WTP) obtained from the double-bounded logit model would be more reliable.

Based on the estimation results, the mean WTP can be using STATA software. Mean WTP was presented

in Malaysian Ringgit (RM)[1]. The calculated mean WTP ranging from RM70.98 to RM220.62 for the single bounded, and for double-bounded ranging from RM76.11 to RM88.59 based on 95 percent confidence interval (Table 3). As double-bounded performed much better than single-bounded, therefore, the mean WTP value of RM82.35 from double-bounded logit model would be taken as the appropriate value for carbon offsets program in aviation industry.

Table 2. Results of single and double bounded regression model Note: *, **, and * indicate statistical significance at the 1%, 5% and 10% respectively.**

	Single-bounded		Double-bounded	
	Coeff.	**Std. Error**	**Coeff.**	**Std. Error**
Constant	1.3454	0.6403	41.5515	18.7470
Bid	-0.0089*	0.0036		
Income	0.0002*	0.0000	0.0047***	0.0015
Education	-0.0061	0.0231	2.1777***	0.5977
Occupation	-0.0726	0.0476	-3.5277***	1.4110
Gender	0.4694**	0.2312	16.8266***	6.6490
Age	-0.0256***	0.0152	-0.1755	0.4366
Log-likelihood function	-287.2083		-633.3383	
Pseudo R^2	0.0901			

Table 3. Estimated of WTP

	Lower Value	**Mean**	**Upper Value**
Single Bounded	RM70.98	RM145.80	RM220.62
Double Bounded	RM76.11	RM82.35	RM88.59

CONCLUSIONS

The objective of this study is to estimate the appropriate price level for willingness to pay for carbon offsets, to have a better environmental performance. The CVM method was used to evaluate the value that people willing to pay for carbon offsets. The study has shown that in average, Malaysian airline passengers are willing to pay about RM82.35 for carbon offset program. Passengers believed that reducing the emissions from their travel is their responsibility, and some of them are aware with the environmental problem like climate change. Thus, they decided to contribute and willing to pay for some amount as an additional amount on top of their airfare. In conclusion, the findings of this research provide insights forMalaysian airline companies to embark into carbon offset program in ensuring a better environmental performance. Besides, this study could encourage and facilitateaviation industry to implement the carbon offset program as an effort to reduce CO_2 emission in Malaysia. Overall, this study confirming the idea that carbon offset program can be done in Malaysian air transportation and it is proven as one of the ways in reducing CO_2 emission.

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[1] As the rates from the Interbank Foreign Exchange Market in Kuala Lumpur (Bank Negara Malaysia) on 1st June 2018: USD1.00 = RM3.9835